

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE
FOR
FMVSS 202aS
Head Restraints – Static Requirements



ENFORCEMENT
Office of Vehicle Safety Compliance
Room 6111, NVS-220
400 Seventh Street, SW
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REVISION CONTROL LOG
FOR OVSC LABORATORY
TEST PROCEDURES

TP-202aS-00
Head Restraints

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PURPOSE AND APPLICATION

The Office of Vehicle Safety Compliance (OVSC) provides contractor laboratories with Laboratory Test Procedures as guidelines for obtaining compliance test data. The data are used to determine if a specific vehicle or item of motor vehicle equipment meets the minimum performance requirements of the subject Federal Motor Vehicle Safety Standard (FMVSS). The purpose of the OVSC Laboratory Test Procedures is to present a uniform testing and data recording format, and provide suggestions for the use of specific equipment and procedures. If any contractor views any part of an OVSC Laboratory Test Procedure to be in conflict with a Federal Motor Vehicle Safety Standard (FMVSS) or observes deficiencies in a Laboratory Test Procedure, the contractor is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing.

Every contractor is required to submit a detailed test procedure to the COTR before initiating the compliance test program. The procedure must include a step-by-step description of the methodology to be used. The contractor's test procedure shall contain a complete listing of test equipment with make and model number and a detailed check-off sheet. The list of test equipment shall include instrument accuracy and calibration dates. All equipment shall be calibrated in accordance with the manufacturer's instructions. There shall be no contradictions between the Laboratory Test Procedure and the contractor's in-house test procedure. Written approval of the in-house test procedures shall be obtained from the COTR before initiating the compliance test program. The OVSC Laboratory Test Procedures are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment which will assist in procuring the required compliance test data. These Laboratory Test Procedures do not constitute an endorsement or recommendation for use of any product or method. However, the application of any such testing technique or equipment is subject to prior approval of the COTR.

NOTE: The OVSC Laboratory Test Procedures, prepared for the limited purpose of use by independent laboratories under contract to conduct compliance tests for the OVSC, are not rules, regulations or NHTSA interpretations regarding the meaning of a FMVSS. The Laboratory Test Procedures are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC Laboratory Test Procedures do not include all of the various FMVSS minimum performance requirements. Recognizing applicable test tolerances, the Laboratory Test Procedures may specify test conditions that are less severe than the minimum requirements of the standard. In addition, the Laboratory Test Procedures may be modified by the OVSC at any time without notice, and the COTR may direct or authorize contractors to deviate from these procedures, as long as the tests are performed in a manner consistent with the standard itself and within the scope of the contract. Laboratory Test Procedures may not be relied upon to create any right or benefit in any person. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits its certification tests to those described in the OVSC Laboratory Test Procedures.

GENERAL REQUIREMENTS

FMVSS 202a, Head Restraints, specifies requirements for head restraints to reduce the frequency and severity of neck injury in rear end and other collisions. The standard applies to each front outboard Designated Seating Position (DSP) and each rear outboard DSP with a head restraint, and allows head restraints to be certified either dynamically or statically. Exception: School buses must only provide a head restraint at the driver's designated seating position.

There are three certification options available to vehicle manufacturers until September 1, 2008: §571.202, ECE 17, or §571.202a. Within §571.202a, manufacturers may choose between S4.2, Dimensional and Static performance and S4.3, Dynamic performance and Width. This test procedure covers only the Dimensional and Static performance requirements.

DEFINITIONS

BACKSET

The minimum horizontal distance between the rear of a representation of the head of a seated 50th percentile male occupant and the head restraint, as measured by the head restraint measurement device (HRMD). HRMD is defined below.

DESIGNATED SEATING POSITION (DSP)

Any plan view location capable of accommodating a person at least as large as a 5th percentile adult female, or if the overall seat configuration and vehicle design is such that the position is likely to be used as a seating position while the vehicle is in motion, with the exception of temporary or folding jump seats.

HEAD RESTRAINT

A device that limits rearward angular displacement of a seated occupant's head relative to the occupant's torso.

HEAD RESTRAINT MEASUREMENT DEVICE (HRMD)

The Society of Automotive Engineers (SAE) (July 1995) J826 three-dimensional manikin with a head form attached, representing the head position of a seated 50th percentile male, with sliding scale at the back of the head for the purpose of measuring backset.

HEIGHT

When used in reference to a head restraint, the distance from the H-point to a point measured parallel to the torso reference line defined by the three dimensional SAE J826 (July 1995) manikin, to a plane normal to the torso reference line.

H-POINT

The mechanically hinged hip point of a manikin, which simulates the actual pivot center of the human torso and thigh described in SAE. Standard J826, July 1995, Devices For Use In Defining And Measuring Vehicle Seating Accommodations.

INTENDED FOR OCCUPANT USE

When used in reference to the adjustment of a seat, positions other than that intended solely for the purpose of allowing ease of ingress and egress of occupants and access to cargo storage areas of a vehicle.

OUTBOARD DESIGNATED SEATING POSITION

A designated seating position where a longitudinal vertical plane tangent to the outboard side of the seat cushion is less than 12 inches from the innermost point on the inside surface of the vehicle at a height between the design H-point and the shoulder reference point and longitudinally between the front and rear edges of the seat cushion.

REAR HEAD RESTRAINT

At any rear outboard designated seating position, a rear seat back or any independently adjustable seat component attached to or adjacent to a seat back that has a height equal to or greater than 700 mm in any position of adjustment.

REAR OUTBOARD DESIGNATED SEATING POSITION

Any outboard designated seating position located rearward of the front designated seating position.

TOP OF THE HEAD RESTRAINT

The point on the head restraint with the greatest height.

TORSO LINE

A line connecting the H-Point and the shoulder reference point as defined in SAE Standard J826, July 1995, Devices For Use In Defining And Measuring Vehicle Seating Accommodations.

COMPLIANCE TEST EXECUTION***TEST METHOD***

All testing shall be performed with the head restraints in their installed for occupant-use configuration in the test vehicle furnished to the contractor. The laboratory test

procedure and associated equipment for testing are based on the requirements of the following documents to the extent referenced herein.

- A. 49 CFR 571.202a, Head Restraints
- B. SAE J826, Devices For Use In Defining And Measuring Seating Accommodations (July 1995)
- C. SAE J1100, Motor Vehicle Dimensions (February 2001)
- D. SAE J211/1, Instrumentation for Impact Test—Part 1—Electronic instrumentation (March 1995)

TEST EQUIPMENT

Test equipment items are listed below. The required range and accuracy of the equipment are included, where applicable. **NOTE:** The equipment list is specific to each individual test, therefore, certain items (e.g. SAE J826 three-dimensional manikin) are listed multiple times.

DIMENSIONAL MEASUREMENT TESTS (including removability and non-use positions)

- A. SAE J826 three-dimensional manikin, July 1995.
- B. 25 mm \pm 0.25 mm diameter sphere
- C. Steel Tape with accuracy of \pm 0.75 mm and sufficient range for measuring the height of the head restraint.
- D. Carpenter's Square
- E. Calipers with accuracy of \pm 0.75 mm and sufficient range for measuring the width of the head restraint.
- F. Head Restraint Measurement Device, HRMD. The SAE J826 three-dimensional manikin with a head form attachment. The head form is available for purchase from ICBC, 151 West Esplanade, North Vancouver, BC V7M 3H9, Canada. www.icbc.com. (Figure 8)
- G. Spherical head form with a 165 \pm 2 mm diameter with surface roughness less than 1.6 μ m, root mean square.
- H. Inclinator with accuracy of \pm 0.2 degrees
- I. 5th percentile female Hybrid III 49 CFR Part 572 Subpart O dummy (non-instrumented)

ENERGY ABSORPTION TEST

- J. Test stand and fixture setup to retain test vehicle and other test equipment needed to conduct head restraint test
- K. SAE J826 three-dimensional manikin with leg length specified in §571.208 10.4.2.1, July 1995.
- L. Steel Tape
- M. Carpenter's Square
- N. Adjustable fixture capable of rigidly fixing the seatback
- O. Semispherical head form with a diameter of 165 ± 2 mm, surface roughness less than $1.6 \mu\text{m}$, root mean square and an accelerometer coincident with the geometric center and base for attachment to the propulsion device. Total mass of 6.8 ± 0.05 kg.
- P. Propulsion device capable of propelling the semispherical head form and base at $23.6 \text{ kph} \pm 0.5 \text{ kph}$ and maintain the semispherical head form and base within 2° of horizontal and parallel to the vehicle longitudinal axis for at least a travel distance of 25 mm.
- Q. Inclinator with accuracy of ± 0.2 degrees
- R. Data acquisition system

HEIGHT RETENTION TEST

- S. Test stand and fixture setup to retain test vehicle and other test equipment needed to conduct height retention test
- T. SAE J826 three-dimensional manikin, July 1995.
- U. Steel Tape
- V. Carpenter's Square
- W. Load application device (at least 1000 N capacity) with an application rate of 250 ± 50 N/minute.
- X. Cylindrical test device with a 165 ± 2 mm diameter and 152 mm length with a surface roughness less than $1.6 \mu\text{m}$, root mean square.
- Y. Linear displacement transducer with a minimum accuracy of ± 0.25 mm
- Z. Data acquisition system

BACKSET RETENTION, DISPLACEMENT, AND STRENGTH TESTS

- AA. Test stand and fixture setup to retain test vehicle and other test equipment needed to conduct the backset tests
- BB. SAE J826 three-dimensional manikin, July 1995.
- CC. Steel Tape
- DD. Carpenter's Square
- EE. Test device with back pan dimensions equivalent to the SAE J826 three-dimensional manikin and rotates about the H-point.
- FF. Load application device (at least 1000 N capacity) capable of rotating to maintain perpendicular load application during displacement of the torso reference line with an application rate of 250 ± 50 N/minute.
- GG. Load cells with a minimum accuracy of ± 0.5 percent.
- HH. Linear displacement transducer with a minimum accuracy of ± 0.25 mm
- II. Data acquisition system

TEST SEQUENCE

The test vehicle and head restraints shall be subject to the tests in the order shown below

- A. Receiving-Inspection of Test Vehicle
- B. Dimensional Measurements (including removability and non-use positions)
- C. Impact and Energy Absorption Tests
 - a. Energy absorption test, S5.2.5
 - b. Height retention test, S5.2.6
 - c. Backset retention, strength, and displacement test, S5.2.7

Prior to conducting the energy absorption, height retention, or backset retention tests, consult with the COTR on which tests to conduct. All three tests cannot be performed on the same head restraint.

RECEIVING-INSPECTION OF TEST VEHICLE

Complete the "Vehicle Condition" form supplied by the COTR.

Upon receipt of the test vehicle, it shall be identified with a visible sign or placard showing the following information:

- A. Vehicle Make/Model
- B. Vehicle Identification Number (VIN)
- C. Vehicle NHTSA number (provided by COTR)
- D. Compliance Test for Head Restraints (S202a).

DIMENSIONAL REQUIREMENTS

The head restraint system, seat, all associated components and trim shall be inspected for function and damage. Record the results of this examination on the "Vehicle Condition Report." If structural damage or other defects are noted that could influence the test results obtain approval from the COTR before initiating the test program.

Prior to conducting any measurements or static tests, the test vehicle must be soaked in an ambient air environment in the temperature range of 19°C to 26°C for a minimum of 4 hours with either the doors open or the windows fully open. For dimensional tests the vehicle may either be placed on a flat, level surface or the vehicle may be secured as required for the energy and impact tests.

The dimensional requirements differ based on head restraint type and designated seating position (DSP). The dimensional requirements are divided into three sections: Front DSP with Integrated Head Restraint, Front DSP with Adjustable Head Restraint, and Rear DSP with Head Restraint. Determine the seat location and type of head restraint and proceed to the appropriate section within the "Dimensional Requirements" section.

FRONT DSP with INTEGRATED HEAD RESTRAINT

HEIGHT MEASUREMENT (Integrated head restraint)

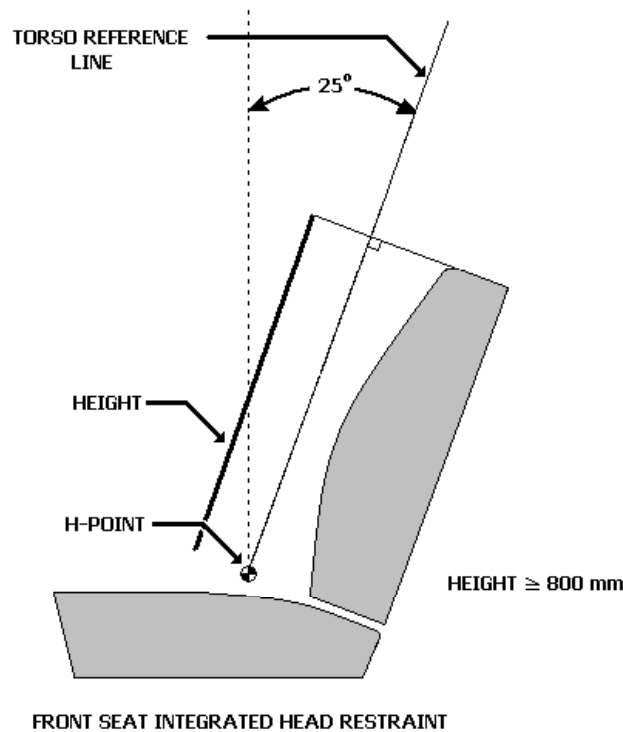


Figure 1

Draw a line denoting the vertical centerline of the seat back.

If the vertical centerline for the head restraint does not coincide with the vertical centerline of the seat back, draw a line denoting the vertical centerline of the head restraint.

The COTR will provide instructions for adjusting the seat to achieve the highest H-point and the seat back angle closest to 25°.

If the seat cushion adjusts independently of the seat back, adjust the seat cushion to the highest H-point position. Depending on the seat design, this may include adjustment of the seat cushion angle in addition to the vertical height adjustment.

If the seat back adjusts, preliminarily set the seat back angle at the closest position to 25° from the vertical. If two positions of adjustment are equidistant from 25°, adjust the seat back to the position rearward of 25°.

Adjust lumbar and side bolster support to the non-inflated or non-extended position.

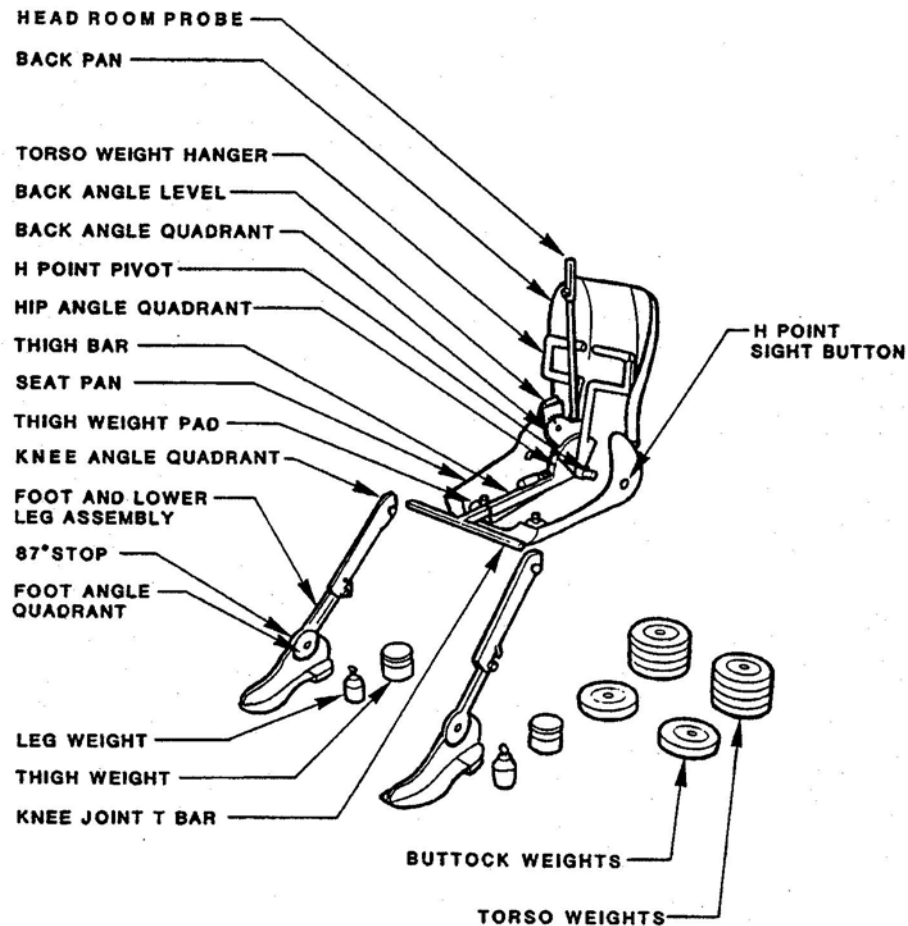


Figure 2 – SAE J826 three-dimensional manikin

Position the SAE J826 three-dimensional manikin in the seat. See “SAE J826 three-dimensional manikin positioning procedure”.

The COTR will provide the manufacturer’s H-point location. Compare the measured H-point to the manufacturer provided data. If the vertical dimension of the H-point deviates from the manufacturer data by more than 10 mm, contact the COTR.

Measure the seat back angle using the back angle quadrant incorporated into the manikin.

Adjust the seat as necessary to achieve the manufacturer provided H-point and the 25° seat back angle.

Record the H-point and seat back angle on Data Sheet 2.

The H-point and seat back angle must be maintained for all tests.

Extend the head room probe incorporated into the SAE J826 three-dimensional manikin along a line parallel to the torso reference line and record the height per definition.

NOTE: The measuring scale on the head room probe uses the bottom surface of the seat pan as the origin of measurement NOT the H-point. The distance between the H-point and the seat pan is approximately 100 mm (4"). The head room probe may be used but a correction factor is necessary to accurately measure the height.

If the head room probe cannot be extended to measure the height because of interference with the seat or head restraint, it may be necessary to measure the height along a line parallel to the torso reference line that will not experience the interference.

It may be necessary to place a straight edge or carpenter's square tangent to the head restraint and perpendicular to the torso reference line to assist in determining the height of the head restraint. See figures 3 and 4.



Figure 3 - Interference of head restraint with head room probe

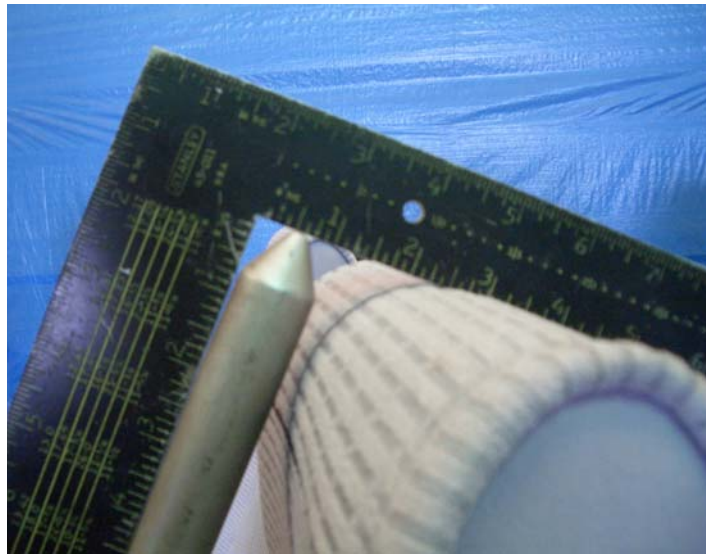


Figure 4 - Carpenter's Square aiding the measurement of the head restraint height

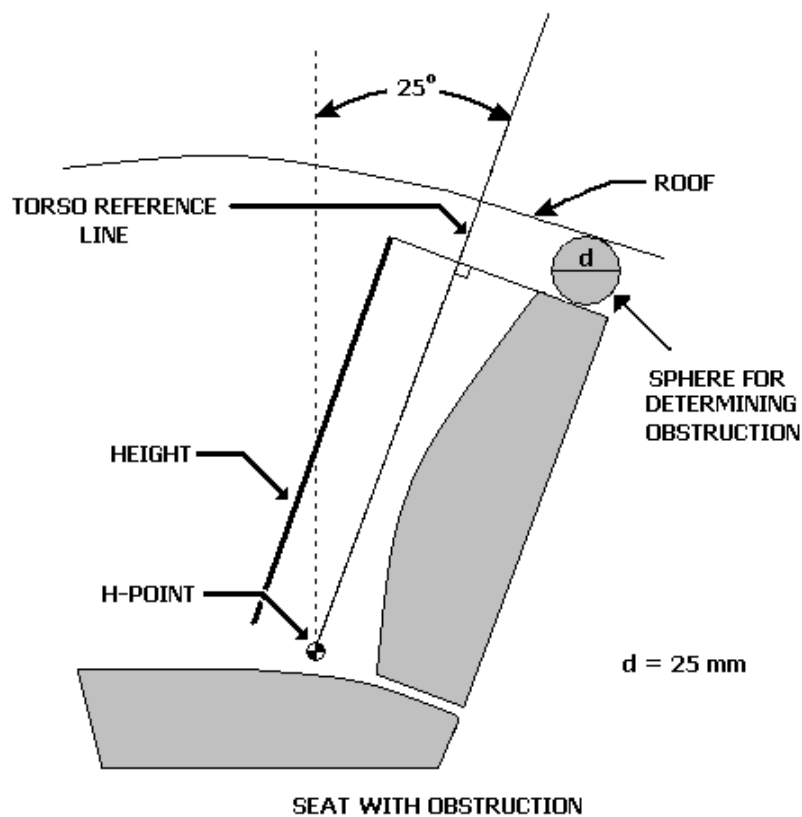


Figure 5

The height must be greater than, or equal to, 800 mm; except if the roof of the vehicle prevents the head restraint from reaching the required height. If this occurs, the head restraint must be of sufficient height to prevent a 25 mm diameter sphere from passing

between the top of the head restraint and the roof. See figure 5. Record on Data Sheet 2.

WIDTH MEASUREMENT (Integrated head restraint)

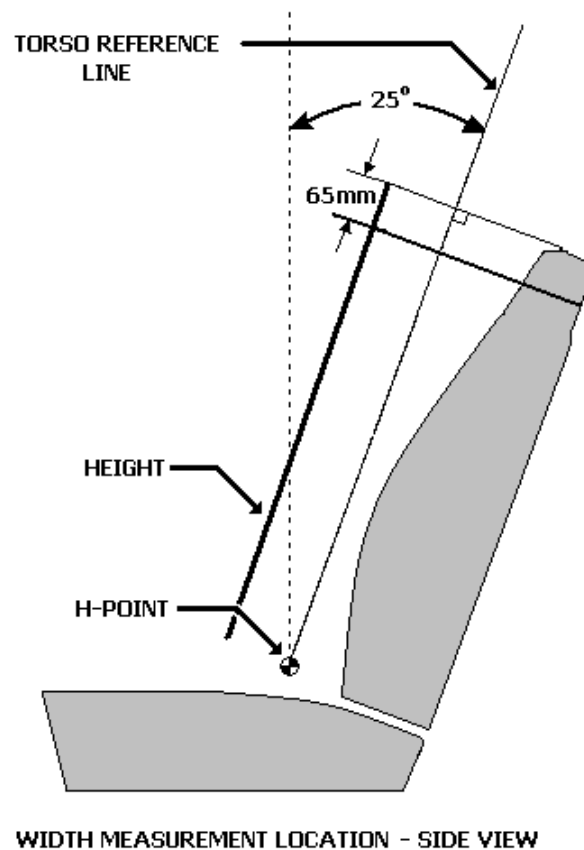


Figure 6

Maintain the position of the SAE J826 three-dimensional manikin as positioned for the height measurement.

Check the torso angle and the location of the head room probe relative to the head restraint center line. Adjust the seat if necessary.

Measure the width of the head restraint at a distance 65 ± 3 mm below the top of the head restraint (Figure 6). The head room probe shall be used to determine the proper height for measuring the width of the head restraint.

At this height, project a plane perpendicular to the torso reference line onto the head restraint.

Using calipers measure the width of the head restraint at the line created by the intersection of the plane and the head restraint. The calipers should be held at the same angle as the plane perpendicular to the torso reference line.

Record the width of the head restraint at this height on Data Sheet 2. See Figures 6 and 7.



Figure 7 - Line indicating the plane 65 mm below the top of an adjustable head restraint

The width must be greater than or equal to 170 mm for vehicles without a front center DSP.

If a vehicle has a front center DSP, the width of the front outboard head restraints must be greater than or equal to 254 mm.

BACKSET MEASUREMENT (Integrated head restraint)



Figure 8

It may be necessary to remove the SAE J826 three-dimensional manikin from the vehicle to attach the head form.

Remove the SAE J826 three-dimensional manikin's torso weights.

Place a total of four of the SAE J826 torso weights on the torso weight hangars, alternating placement left and right. Place the two larger HRMD torso weights, flat side down on the hangars, these weights shall be placed last.

Attach the HRMD head form to the SAE J826 three-dimensional manikin.

The head form portion of the HRMD shall be leveled by loosening the rear knob and repositioning the head using the incorporated bubble level; the knob shall then be retightened by hand.

If the SAE J826 three-dimensional manikin was removed from the seat, re-seat the HRMD following the instructions in "SAE J826 manikin positioning procedure."

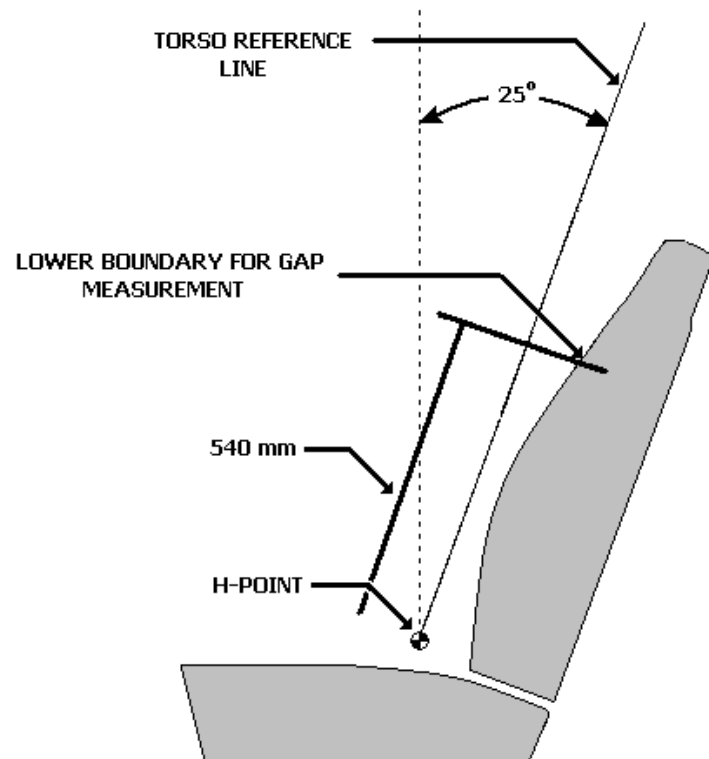
Verify the torso angle is 25° and the head room probe is within 15 mm of the head restraint center line. Adjust the seat if necessary.

Extend the sliding scale on the back of the head until it contacts the head restraint.

Record the backset on Data Sheet 2.

The measured backset shall be less than or equal to 55 mm.

GAP MEASUREMENT (Integrated head restraints)



LOCATING THE LOWER BOUNDARY FOR GAP MEASUREMENT - SIDE VIEW

Figure 9

Maintain the position of the SAE J826 three-dimensional manikin as positioned for the height, width, and backset measurements. Check the torso angle and location of the head room probe relative to the head restraint center line. Adjust the seat if necessary.

Extend the head room probe of the SAE J826 three-dimensional manikin along a line parallel to the torso reference line to a height of 540 mm. Project a plane perpendicular to the torso reference line. On the seat back, mark the line that represents the intersection of the projected plane and the seat back.

Remove the SAE J826 three-dimensional manikin.

Locate the vertical centerline of the seat back.

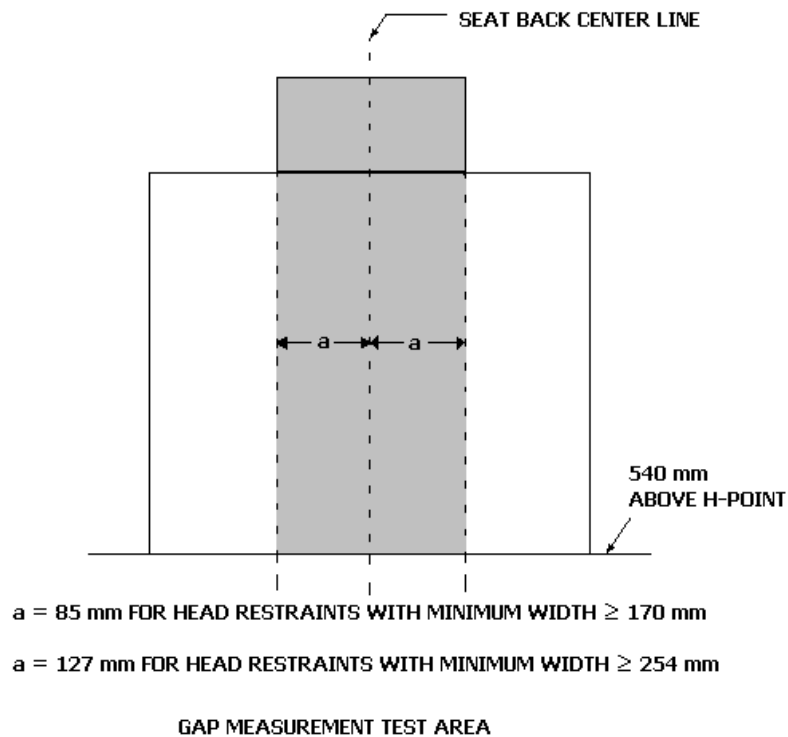


Figure 10

Note: The previous steps for locating and marking the plane at 540 mm may be performed in conjunction with the “Height Measurement.”

For seats required to have 170 mm head restraint width, measure 85 mm from the seat back centerline and draw a line on each side of, and parallel to, the seat back centerline.

For seats required to have 254 mm head restraint width, measure 127 mm from the seat back centerline and draw a line on each side of, and parallel to, the seat back centerline.

The area bounded by the line at a height of 540 mm, the two lines parallel to the seat back vertical centerline, and the top surface of the head restraint, is the area that must not contain any gaps larger than 60 mm.

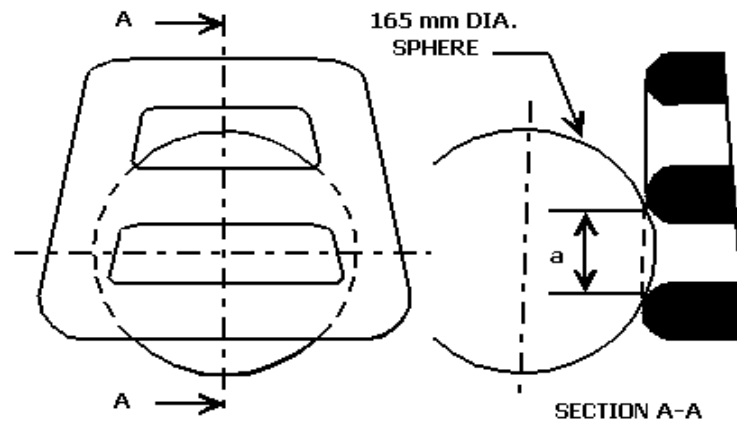


Figure 11

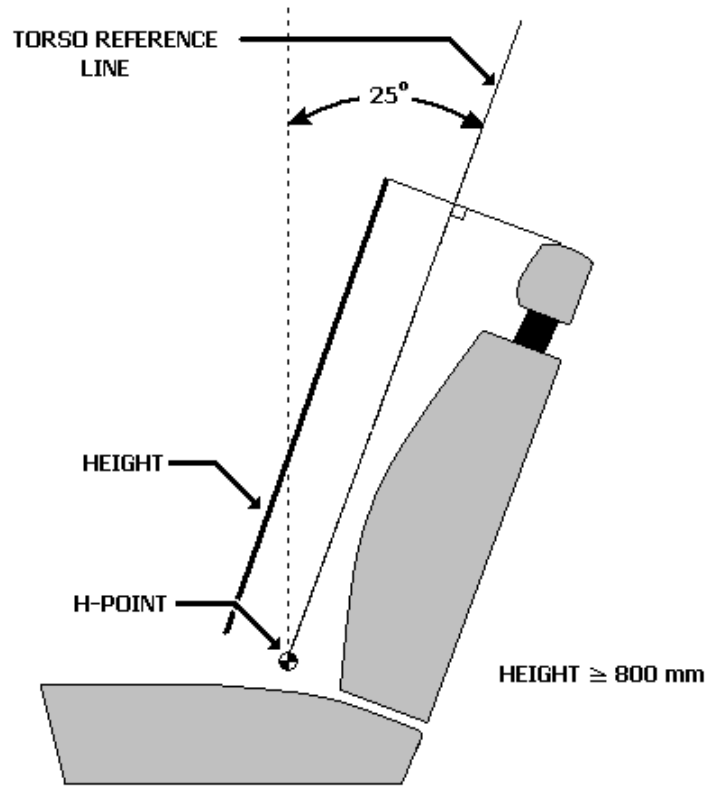
Using a steel tape or rule, measure the least dimension (“a” in Figure 11) of any gap within the relevant area. If the least dimension of the gap is less than 50 mm, record the measurement on Data Sheet 2 and proceed without using the spherical head form. If the least dimension of the gap, when measured with a steel tape, exceeds 50 mm, use the spherical head form to determine compliance.

Place the 165 mm diameter spherical head form against any gap such that at least two points of contact are made within the area. In placing the head form against a gap, do not exceed a force of 5 N (~1 lb). Measure the straight line distance between the inner edges of the two furthest contact points.

It may be necessary to use a transferable medium to facilitate accurate measurement of the gap using the spherical head form. Chalk water such as that which is used to paint the anthropomorphic test devices’ face in FMVSS 208 or lipstick which is used for the “heads and knees” test in FMVSS 222 would be suitable for this purpose.

FRONT DSP with ADJUSTABLE HEAD RESTRAINT

HEIGHT MEASUREMENT (Adjustable head restraints)



FRONT SEAT ADJUSTABLE HEAD RESTRAINT IN HIGHEST POSITION

Figure 12

Draw a line denoting the vertical centerline of the seat back.

If the vertical centerline for the head restraint does not coincide with the vertical centerline of the seat back, draw a line denoting the vertical centerline of the head restraint.

The COTR will provide instructions for adjusting the seat to achieve the highest H-point and the seat back angle closest to 25°.

If the seat cushion adjusts independently of the seat back, adjust the seat cushion to the highest H-point position. Depending on the seat design, this may include adjustment of the seat cushion angle in addition to the vertical height adjustment.

If the seat back adjusts, preliminarily set the seat back angle at the closest position to 25° from the vertical. If two positions of adjustment are equidistant from 25°, adjust the seat back to the position rearward of 25°.

Adjust lumbar and side bolster support to the non-inflated or non-extended position.

Adjust the head restraint to the highest position for occupant use.

Position the SAE J826 three-dimensional manikin in the seat. See “SAE J826 three-dimensional manikin positioning procedure”.

The head room probe shall be positioned laterally within 15 mm of the centerline of the head restraint.

Measure the seat back angle using the back angle quadrant incorporated into the manikin.

Adjust the seat as necessary to achieve the target H-point and seat back angle.

Record the H-point and seat back angle on Data Sheet 2a.

The H-point and seat back angle must be maintained for all tests.

Extend the head room probe incorporated into the SAE J826 three-dimensional manikin along a line parallel to the torso reference line and record the height.

NOTE: The measuring scale on the head room probe uses the bottom surface of the seat pan as the origin of measurement NOT the H-point. The distance between the H-point and the seat pan is approximately 100 mm (4”). The head room probe may be used but a correction factor is necessary to accurately measure the height.

If the head room probe cannot be extended to measure the height because of interference with the seat or head restraint, it may be necessary to measure the height along a line parallel to the torso reference line that will not experience the interference.

It may be necessary to place a straight edge or carpenter’s square tangent to the head restraint and perpendicular to the torso reference line to assist in determining the height of the head restraint. See Figures 3 and 4.

The height must be greater than or equal to 800 mm; except if the roof of the vehicle prevents the head restraint from reaching the required height. If this occurs, the head restraint must be of sufficient height to prevent the passage of a 25 mm diameter sphere from passing between the top of the head restraint and the roof. See figure 5. Record on Data Sheet 2a.

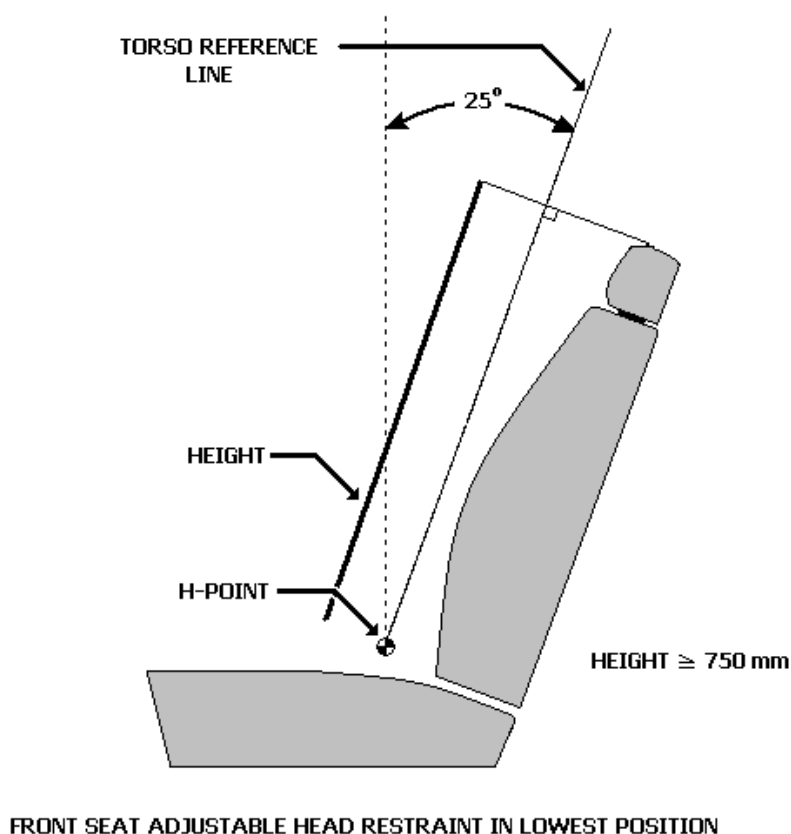


Figure 13

Adjust the head restraint to the lowest position for occupant use.

Maintain the position of the SAE J826 three-dimensional manikin as positioned for the height measurement with the head restraint in the highest position.

Check the torso angle and location of the head room probe relative to the head restraint center line. Adjust the seat if necessary.

Extend the head room probe incorporated into the SAE J826 three-dimensional manikin along a line parallel to the torso reference line and record the height.

If the head room probe cannot be extended to measure the height because of interference with the seat or restraint, it may be necessary to measure the height along a line parallel to the torso reference line that will not experience the interference.

It may be necessary to place a straight edge or carpenter's square tangent to the head restraint and perpendicular to the torso reference line to assist in determining the height of the head restraint. See Figures 3 and 4.

The height must be greater than or equal to 750 mm. Record on Data Sheet 2a.

WIDTH MEASUREMENT (Adjustable head restraints)

Maintain the position of the SAE J826 three-dimensional manikin as positioned for the height measurement.

The head restraint may be placed at any position of adjustment.

Check the torso angle and location of the head room probe relative to the head restraint center line. Adjust the seat if necessary.

Measure the width of the head restraint at a distance 65 ± 3 mm below the top of the head restraint. See example in Figure 6. The head room probe shall be used to determine the proper height for measuring the width of the head restraint.

At this height, project a plane perpendicular to the torso reference line onto the head restraint.

Using calipers measure the width of the head restraint at the line created by the intersection of the plane and the head restraint. The calipers should be held at the same angle as the plane perpendicular to the torso reference line.

Record the width of the head restraint at this height on Data Sheet 2a. See Figures 6 and 7 for examples.

The width must be greater than or equal to 170 mm for vehicles without a front center DSP.

If a vehicle has a front center DSP the width of the front outboard head restraints must be greater than or equal to 254 mm.

BACKSET MEASUREMENT (Adjustable head restraints)

It may be necessary to remove the SAE J826 three-dimensional manikin from the vehicle to attach the head form.

Remove the SAE J826 three-dimensional manikin's torso weights.

Place a total of four of the SAE J826 torso weights on the torso weight hangars, alternating placement left and right. Place the two larger HRMD torso weights, flat side down on the hangars, these weights shall be placed last.

Attach the HRMD head form to the SAE J826 three-dimensional manikin.

The head form portion of the HRMD shall be leveled by loosening the rear knob and repositioning the head using the incorporated bubble level; the knob shall then be retightened by hand.

If the SAE J826 three-dimensional manikin was removed from the seat, re-seat the HRMD following the instructions in "SAE J826 manikin positioning procedure."

Verify the torso angle is 25° and the head room probe is within 15 mm of the head restraint center line. Adjust the seat if necessary.

Adjust the head restraint such that the top of the head restraint is at any position of adjustment greater than, or equal to, 750 mm and less than, or equal to, 800 mm.

When measuring the height of the head restraint, note the position of adjustment for the backset measurement.

If no position of adjustment exists at or below 800 mm, adjust the head restraint to the lowest position. If adjustable, backset should be adjusted to the most rearward position.

Extend the sliding scale on the back of the head until it contacts the head restraint.

Record the backset on Data Sheet 2a.

The measured backset shall be less than or equal to 55 mm.

See figure 8.

GAP MEASUREMENT (Adjustable head restraints)

Maintain the position of the SAE J826 three-dimensional manikin as positioned for the height, width, and backset measurements.

Adjust the head restraint to the lowest position with any backset position.

Check the torso angle and location of the head room probe relative to the head restraint center line. Adjust the seat if necessary.

Extend the head room probe of the SAE J826 three-dimensional manikin along a line parallel to the torso reference line to a height of 540 mm. Project a plane perpendicular to the torso reference line. On the seat back, mark the line that represents the intersection of the projected plane and the seat back.

Remove the SAE J826 three-dimensional manikin.

Locate the vertical centerline of the seat back.

Note: The previous steps for locating and marking the plane at 540 mm may be performed in conjunction with the “Height Measurement.”

For seats required to have 170 mm head restraint width, measure 85 mm from the seat back centerline and draw a line on each side of, and parallel to the seat back centerline.

For seats required to have 254 mm head restraint width, measure 127 mm from the seat back centerline and draw a line on each side of, and parallel to the seat back centerline.

The area bounded by the line at a height of 540 mm, the two lines parallel to the seatback vertical centerline, and the top surface of the head restraint, is the area that must not contain any gaps larger than 60 mm.

Using a steel tape or rule, measure the least dimension (“a” in Figure 11) of any gap within the relevant area. If the least dimension of the gap is less than 50 mm, record the measurement on Data Sheet 2a and proceed without using the spherical head form. If the least dimension of the gap, when measured with a steel tape, exceeds 50 mm, use the spherical head form to determine compliance.

Place the 165 mm diameter spherical head form against any gap such that at least two points of contact are made within the area. In placing the head form against a gap, do not exceed a force of 5 N (~1 lb). Measure the straight line distance between the inner edges of the two furthest contact points.

See figures 9, 10, and 11.

It may be necessary to use a transferable medium to facilitate accurate measurement of the gap using the spherical head form. Chalk water such as that which is used to paint the anthropomorphic test devices’ face in FMVSS 208 or lipstick which is used for the “heads and knees” test in FMVSS 222 would be suitable for this purpose.

REAR DSP with HEAD RESTRAINT

The “Height measurement” portion is used for determining both if a head restraint exists and the height of a head restraint should it exist.

HEIGHT MEASUREMENT (Rear seat)

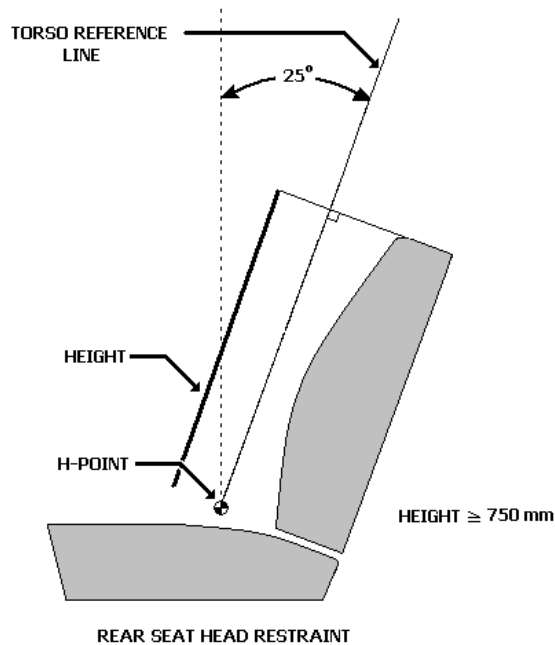


Figure 14

Draw a line denoting the vertical centerline of the seat back for an outboard designated seating position or the head restraint-like device.

The COTR will provide instructions for adjusting the seat to achieve the highest H-point and the seat back angle closest to 25°.

If the seat cushion adjusts independently of the seat back, adjust the seat cushion to the highest H-point position. Depending on the seat design, this may include adjustment of the seat cushion angle in addition to the vertical height adjustment.

If the seat back adjusts, preliminarily set the seat back angle at the closest position to 25° from the vertical. If two positions of adjustment are equidistant from 25°, adjust the seat back to the position rearward of 25°.

Adjust lumbar and side bolster support to the non-inflated or non-extended position.

If the head restraint-like device is adjustable, position the head restraint-like device in the highest position of adjustment for occupant use.

Position the SAE J826 three-dimensional manikin in the seat. See “SAE J826 three-dimensional manikin positioning procedure”.

The COTR will provide the manufacturer's H-point location. Compare the measured H-point to the manufacturer provided data. If the vertical dimension of the H-point deviates from the manufacturer data by more than 10 mm, contact the COTR.

Measure the seat back angle using the back angle quadrant incorporated into the manikin.

Adjust the seat as necessary to achieve the manufacturer provided H-point and seat back angle.

Record the H-point and seat back angle on either Data Sheet 2 or 2a, depending on the head restraint design (integrated versus adjustable).

The H-point and seat back angle must be maintained for all tests.

Extend the head room probe incorporated into the SAE J826 three-dimensional manikin along a line parallel to the torso reference line and record the height.

NOTE: The measuring scale on the head room probe uses the bottom surface of the seat pan as the origin of measurement NOT the H-point. The distance between the H-point and the seat pan is approximately 100 mm (4"). The head room probe may be used but a correction factor is necessary to accurately measure the height.

If the head room probe cannot be extended to measure the height because of interference with the seat or restraint, it may be necessary to measure the height along a line parallel to the torso reference line that will not experience the interference.

It may be necessary to place a straight edge or carpenter's square tangent to the head restraint and perpendicular to the torso reference line to assist in determining the height of the head restraint-like device. See Figures 3 and 4.

If the height is greater than or equal to 700 mm then a rear head restraint exists.

If a head restraint exists, the height must be greater than or equal to 750 mm for integrated head restraints and adjustable head restraints in the highest position.

Record the height on either Data Sheet 2 or 2a.

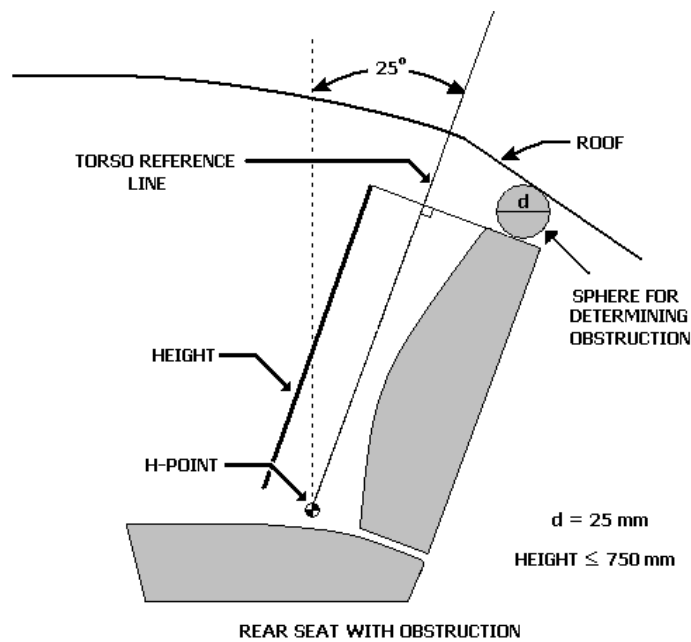


Figure 15

EXCEPTION:

If the head restraint is less than 750 mm in height but greater than 700 mm in height, measure the clearance between the top of the head restraint and the roofline or backlight. Determine the clearance by attempting to pass a 25 mm diameter sphere between the head restraint and the roof or backlight. If the sphere passes between the top of the head restraint and the roof or backlight then the head restraint fails the height requirement.

WIDTH MEASUREMENT (Rear seat)

Maintain the position of the SAE J826 three-dimensional manikin as positioned for the height measurement.

Check the torso angle and location of the head room probe relative to the head restraint center line. Adjust the seat if necessary.

Measure the width of the head restraint at a distance 65 ± 3 mm below the top of the head restraint (Figure 6). The head room probe shall be used to determine the proper height for measuring the width of the head restraint.

At this height, project a plane perpendicular to the torso reference line onto the head restraint.

Using calipers measure the width of the head restraint at the line created by the intersection of the plane and the head restraint. The calipers should be held at the same angle as the plane perpendicular to the torso reference line.

Record the width of the head restraint at this height on either Data Sheet 2 or 2a. See Figures 6 and 7.

The width must be greater than or equal to 170 mm.

GAP MEASUREMENT (Rear seat)

Maintain the position of the SAE J826 three-dimensional manikin as positioned for the height and width measurements. Check the torso angle and location of the head room probe relative to the head restraint center line. Adjust the seat if necessary.

Adjust the head restraint to the lowest position.

Extend the head room probe of the SAE J826 three-dimensional manikin along a line parallel to the torso reference line to a height of 540 mm. Project a plane perpendicular to the torso reference line. On the seat back, mark the line that represents the intersection of the projected plane and the seat back.

Remove the SAE J826 three-dimensional manikin.

Locate the vertical centerline of the seat back.

Note: The previous steps for locating and marking the plane at 540 mm may be performed in conjunction with the “Height Measurement”.

Measure 85 mm from the seat back centerline and draw a line, on each side of, and parallel to the seat back centerline.

The area bounded by the line at a height of 540 mm, the two lines parallel to the seat back vertical centerline, and the top surface of the head restraint, is the area that must not contain any gaps larger than 60 mm.

Using a steel tape or rule, measure the least dimension (“a” in Figure 11) of any gap within the relevant area. If the least dimension of the gap is less than 50 mm, record the measurement on Data Sheet 2 or 2a and proceed without using the spherical head form. If the least dimension of the gap, when measured with a steel tape, exceeds 50 mm, use the spherical head form to determine compliance.

Place the 165 mm diameter spherical head form against any gap such that at least two points of contact are made within the area. In placing the head form against a gap, do not exceed a force of 5 N (~1 lb). Measure the straight line distance between the inner edges of the two furthest contact points.

It may be necessary to use a transferable medium to facilitate accurate measurement of the gap using the spherical head form. Chalk water such as that which is used to paint the anthropomorphic test devices’ face in FMVSS 208 or lipstick which is used for the “heads and knees” test in FMVSS 222 would be suitable for this purpose.

See figures 9, 10, and 11.

SAE J826 three-dimensional manikin positioning procedure

SAE J826 Revised JUL95

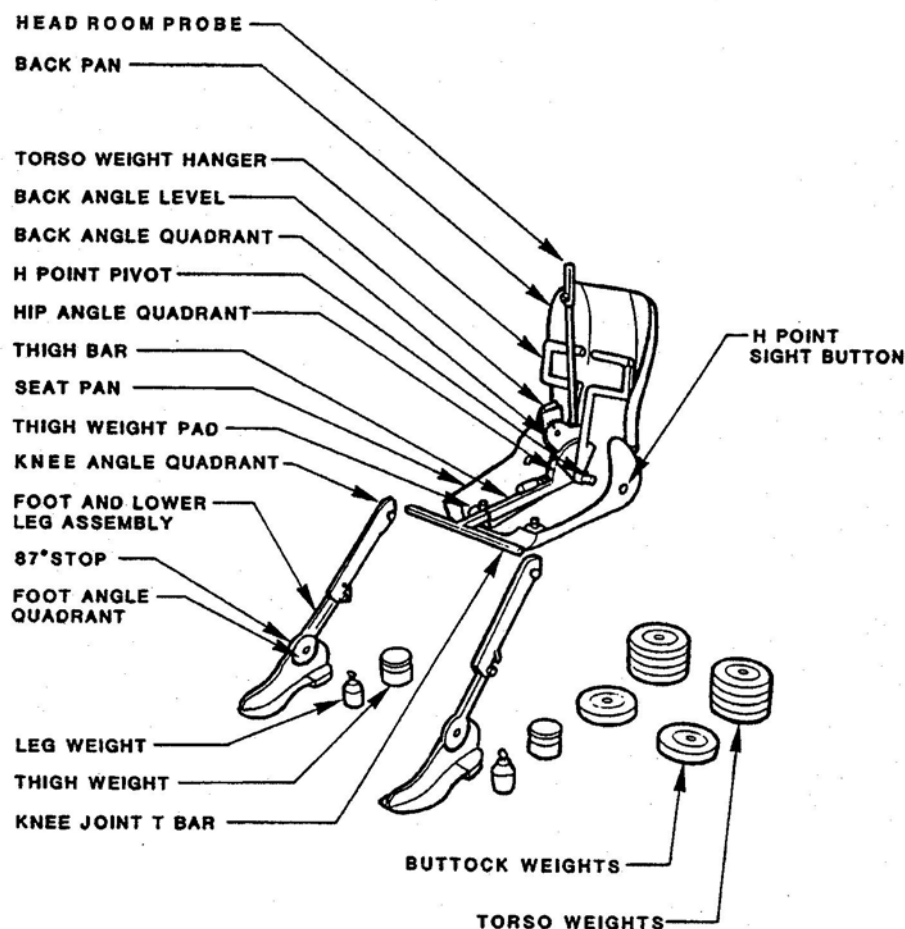


Figure 16

Place a piece of muslin cotton cloth over the seat area to be tested. The muslin cloth should be 910 mm (36 in) square and of a quality comparable to a grade described as a weave of 48 threads/in² and density of 2.85 yd/lb. The muslin should be tucked in a sufficient amount to prevent hammocking of the material.

Place seat and back assembly of the SAE J826 three-dimensional manikin ensuring that the head room probe is within 15 mm laterally of the centerline of the head restraint.

Attach foot and lower leg assemblies to the seat pan assembly, either individually at the knee joint or by using the T-bar lateral segment and lower leg assembly. The lower leg length is set to 15.8" and the thigh length is set to 16.3".

The T-bar lateral segment should be parallel to the ground and perpendicular to the longitudinal centerline of the vehicle.

The feet and leg positions of the SAE J826 three-dimensional manikin for the various individual seat positions are as follows:

Front Seat—The right foot and leg assembly is placed on the undepressed accelerator pedal with the sole of the foot on the pedal and the heel as far forward as allowable. The right leg is adjusted inboard on the T-bar toward the centerline of the vehicle until just contacting the tunnel (or other components) or until the Ball of Foot on the shoe is aligned with the center of the accelerator pedal pad. Tunnel contact at the heel is defined where the Heel Point on the foot is at the beginning transition of horizontal to upturned compressed carpet surface. The heel may not be placed on the toe board. However, the foot angle is never less than 87 degrees. The 87 degree limit can be fixed by inserting the pin into the foot assembly. The left foot is positioned on the floor or toe pan and located approximately the same distance to the left of the H-Point machine centerline as the right foot is to the right. The T-bar should be maintained parallel to the ground. In vehicles having no tunnel, the feet are set approximately 254 mm (10 in) apart.

Rear Seat—Outboard Position—The two feet are placed together and positioned to the nearest interference of the toe, instep, or lower leg with the front seat, unless otherwise specified by the manufacturer. In instances where one foot reaches interference before the other, the one with the nearest interference will be used for dimensioning purposes.

Apply lower leg and thigh weights and level the SAE J826 three-dimensional manikin.

Tilt the back pan forward against the forward stop and draw the SAE J826 three-dimensional manikin away from the seatback using the T-bar. Reposition the SAE J826 three-dimensional manikin on the seat by one of the following methods:

If the SAE J826 three-dimensional manikin tends to slide rearward, use the following procedure:

Allow the SAE J826 three-dimensional manikin to slide rearward until a forward horizontal restraining load on the T-bar is no longer required due to the seat pan contacting the seatback.

If the SAE J826 three-dimensional manikin does not tend to slide rearward, use the following procedure:

Slide the SAE J826 three-dimensional manikin rearward by a horizontal rearward load applied at the T-bar until the seat pan contacts the seatback.

Apply a 10 kg (22 lb) load twice to the back and pan assembly positioned at the intersection of the hip angle quadrant and the T-bar housing. The direction of load application should be maintained along a line from the above intersection to a point just above the thigh bar housing. Then carefully return the back pan to the seatback. Care must be exercised through the remainder of the procedure to prevent the SAE J826 three-dimensional manikin from sliding forward.

Install the right and left buttock weights and then alternately the eight torso weights.

Maintain the SAE J826 three-dimensional manikin level.

Tilt the back pan forward until the stop is contacted. Rock the SAE J826 three-dimensional manikin from side to side over a 10 degree arc (5 degrees to each side of the vertical centerline) for three complete cycles to release any accumulated friction between the SAE J826 three-dimensional manikin and the seat. During the rocking, the T-bar of the SAE J826 three-dimensional manikin may tend to change from the specified horizontal and vertical alignment; therefore, the T-bar must be restrained and properly aligned by applying an appropriate lateral load during the rocking motions. Care shall be exercised in holding the T-bar and rocking the SAE J826 three-dimensional manikin to minimize inadvertent exterior loads applied in a vertical or fore-and-aft direction. The SAE J826 three-dimensional manikin's feet are not to be restrained or held during this step, and if the feet change position, they should be allowed to remain in that attitude at this time.

Due to the movement of the feet during the SAE J826 three-dimensional manikin rocking operation, the feet are repositioned as follows:

Front Seat—Alternately lift each foot off the floor the minimum necessary amount until no additional forward foot movement is obtained. During this lifting, the feet are to be free to rotate and no forward or lateral loads are to be applied. When each foot is placed back in the down position, the heel is to be in contact with the floor and the ball (sole) of the foot is to be in contact with the floor, toe board, or undepressed accelerator pedal.

Rear Seat—Alternately move each foot forward by applying a forward load to the heel of the foot, sliding the feet forward until the feet or leg interfere with the rear of the front seatback. This operation releases any accumulated foot friction and movement incurred during the lateral rocking step. If the seat pan is not level at the completion of this step, apply a sufficient lateral load to the top of the seatback pan to level the SAE J826 three-dimensional manikin seat pan on the seat.

Holding the T-bar to prevent the SAE J826 three-dimensional manikin from sliding forward on the seat cushion, proceed as follows:

Return the back pan to the seatback.

Apply a rearward force perpendicular to the back angle bar just above the torso weights using either one of the following methods:

Sufficient force to increase the hip angle by 3 degrees or

Increasing the hip angle up to 3 degrees by increasing the applied force up to a maximum of 66 N (15 lb).

Alternately apply and release this force until the hip angle readout indicates that the back pan has reached a stable position after the applied force has been released, that is, repeated identical hip angle readouts. Care shall be exercised to minimize exterior downward or side forces applied to SAE J826 three-dimensional manikin. If an SAE J826 three-dimensional manikin level adjustment is necessary, rotate the back pan forward, re-level, and repeat the SAE J826 three-dimensional manikin back rocking.

If a rerun of the SAE J826 three-dimensional manikin installation is desired, the seat assembly should remain unloaded for a minimum period of 1/2 hour prior to the rerun. The loaded SAE J826 three-dimensional manikin should not be left on the assembly longer than the time required to perform the test.

OWNER'S MANUAL

The owner's manual must include the following information:

- 1) Description of the head restraint system
- 2) Seats equipped with a head restraint system
- 3) For removable head restraints, instructions for removal by a deliberate action distinct from any action to adjust the restraint and reinstallation
- 4) Warning that head restraints must be installed properly to protect occupants
- 5) Description of how to properly position the head restraint including:
 - a. main components
 - b. proper positioning of head restraint height relative to the occupant's head center of gravity
 - c. actions that may affect the proper function of the head restraints

Include copies of the relevant pages from the owner's manual in the test report.

REMOVABILITY

Head restraints may be removable. Consult the owner's manual for removal instructions.

Record, on Data Sheet 4, the required actions to remove the head restraint.

The action(s) necessary to remove the head restraint must be distinct from the action(s) to adjust the head restraint.

For example, pushing the same button to adjust height and to remove the restraint is not permitted.

Verify that the head restraint removal action is distinct from the action to adjust for normal use.

Remove the head restraint.

Reinstall the head restraint, per the owner's manual instructions.

Include copies of the relevant pages from the owner's manual in the test report.

NON-USE POSITIONS

Rear seat head restraints may have a position that is intended for other than occupant use (e.g. seats fold down to provide for additional cargo space). In the non-use position the head restraint does not need to comply with height requirement.

The head restraint must automatically return to an in-use position when the seat is occupied by a 5th percentile female or the head restraint must manually rotate at least 60° between a non-use position and an in-use position. Non-use positions are not permitted for the front seat head restraints.

Consult the owner's manual to determine if a non-use position is provided for the rear seat head restraints. Record, on Data Sheet 5, the instructions for positioning and returning the head restraint to and from a non-use position.

Include copies of the relevant pages from the owner's manual in the test report.

Manual return head restraints

If the head restraint is manually returned to an in-use position from a non-use position, strike a straight line on the side of the head restraint. Measure the angle created between the line and the horizontal for the head restraint in a non-use position. Position the head restraint in an in-use position and measure the angle created between the line and the horizontal.

The change in angle between the initial position and the final position must be greater than or equal to 60°.

Automatic return head restraints

With the seat unoccupied, place the key in the ignition and turn to the "run" position. Wait 1 minute. If the head restraint automatically moves to a non-use position, allow for the completion of the movement. If the head restraint does not automatically move to a non-use position, adjust the head restraint to a non-use position. Turn the key to the "off" position.

With the head restraint in a non-use position, position a 5th percentile female Hybrid III, Subpart O, test dummy in the seat.

The midsagittal plane shall be within 15 mm of the head restraint centerline and in a vertical plane parallel to the vehicle centerline.

Hold the dummy's thighs down and push rearward on the upper torso to maximize the pelvic angle.

Place the legs as close as possible to 90° to the thighs.

Push rearward on the dummy's knees to force the pelvis into the seat so there is no gap between the pelvis and the seat back or until contact occurs between the back of the dummy's calves and the front of the seat cushion such that the angle between the dummy's thighs and legs begins to change.

Place the key in the ignition in the "run" position. Wait 1 minute. Record the location of the head restraint. Turn the key to the "off" position. Remove the dummy and if necessary position the SAE J826 three-dimensional manikin to determine that the height of the head restraint is within the minimum requirement.

IMPACT AND ENERGY ABSORPTION TESTS

The head restraint static tests shall be performed inside the vehicle. The vehicle shall be secured by the method indicated in, “Vehicle Securement for FMVSS No. 202, 216, and 225 testing” (Appendix A). The roof, windshield, doors, and pillars may need to be removed to conduct some or all of the impact and energy absorption tests. DO NOT remove any portion of the vehicle prior to conducting the dimensional measurements. Consult with the COTR prior to removing any portion of the vehicle. The laboratory shall minimize the amount of vehicle removed for conducting the tests described in this procedure.

ENERGY ABSORPTION

Position the head restraint in any position of adjustment for occupant use. The laboratory shall consult with the COTR regarding the specific position of adjustment desired.

The following measurements may be performed during the dimensional measurements highlighted previously.

The COTR will provide instructions for adjusting the seat to achieve the highest H-point and the seat back angle closest to 25°.

If the seat cushion adjusts independently of the seat back, adjust the seat cushion to the highest H-point position. Depending on the seat design, this may include adjustment of the seat cushion angle in addition to the vertical height adjustment.

If the seat back adjusts, preliminarily set the seat back angle at the closest position to 25° from the vertical. If two positions of adjustment are equidistant from 25°, adjust the seat back to the position rearward of 25°.

Adjust lumbar and side bolster support to the non-inflated or non-extended position.

Position the SAE J826 three-dimensional manikin in the seat. See the “SAE J826 three-dimensional manikin positioning procedure”. The head room probe shall be positioned laterally within 15 mm of the centerline of the head restraint. Verify the H-point. Measure the seat back angle using the back angle quadrant incorporated into the manikin. Adjust the seat as necessary to achieve the H-point and seat back angle.

Extend the head room probe of the SAE J826 three-dimensional manikin along a line parallel to the torso reference line to a height of 635 mm. Project a plane perpendicular to the torso reference line. On the seat back, mark the line that represents the intersection of the projected plane and the seat back.

Remove the SAE J826 three-dimensional manikin.

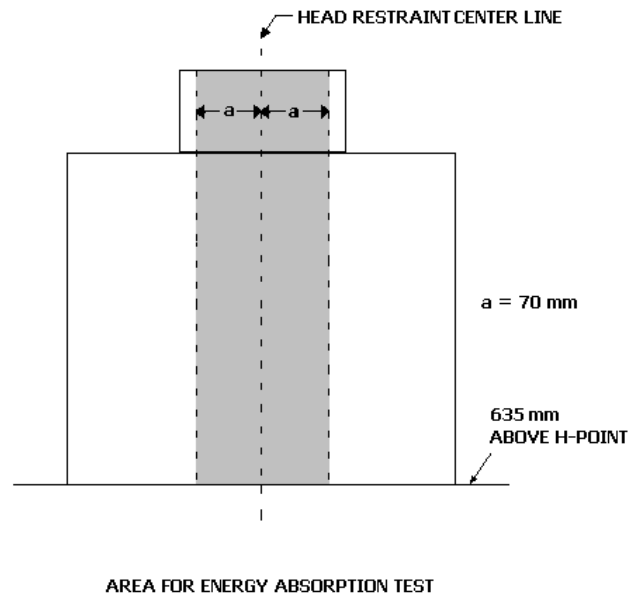


Figure 17

Locate the vertical centerline of the head restraint.

Measure 70 mm outboard from the head restraint vertical centerline and draw a line parallel to the head restraint centerline. Measure 70 mm inboard from the head restraint vertical centerline and draw a line parallel to the head restraint centerline.

The area bounded by the line at a height of 635 mm, the two lines parallel to the head restraint vertical centerline, and the top surface of the head restraint, is the area that must comply with the energy absorption requirements of S4.2.5.

Rigidly fix the seat back.

Rigidly fixing the seat back may involve welding or blocking the hinge between the seat cushion and the seat back. Additionally an external brace may be welded to the seat frame and to the vehicle body. The method of rigidly fixing the seat back shall be approved by the COTR, standard engineer and the contracted test laboratory.

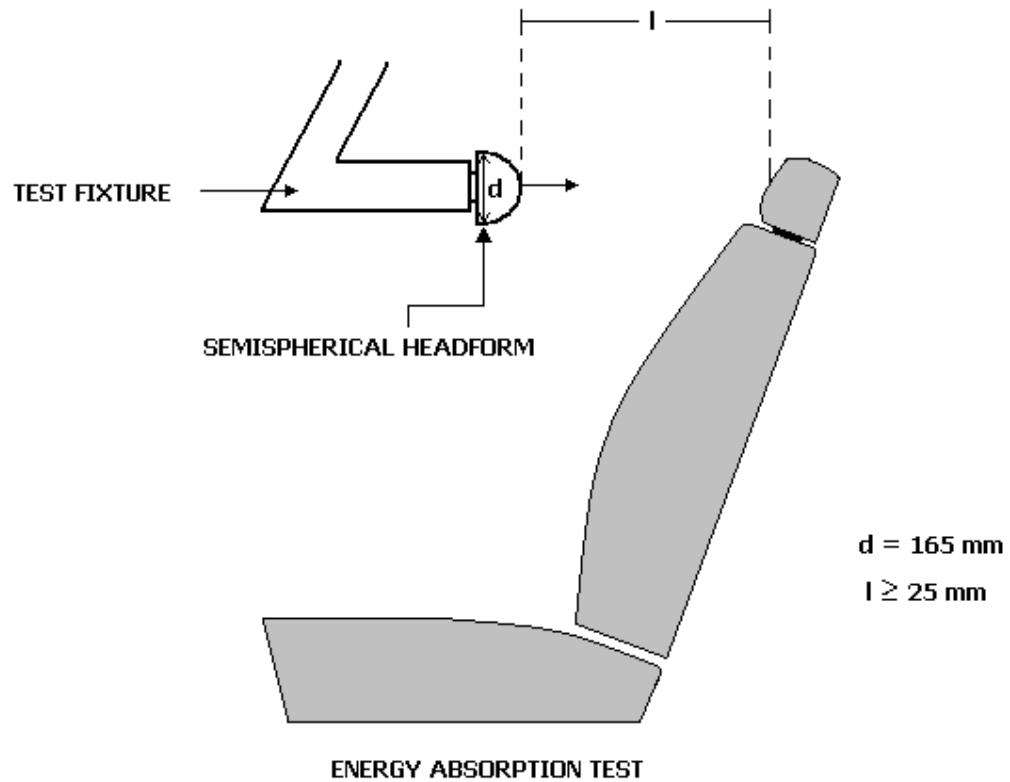


Figure 18

In consultation with the COTR, select an impact zone within the area described in Figure 17.



Figure 19 - Head form tangent to impact location (pre-test)

Install the head form actuator in the test vehicle forward of the impact area selected for the test. Installation of the head form actuator may require the removal of doors, windshield, roof or other components. See Figures 18 and 19.

Seats to be tested shall not be removed.

The COTR shall be consulted prior to removing any portion of the vehicle.

Ensure that the accelerometer is properly mounted at the geometric center of the head form and that the accelerometer output is properly connected to the data acquisition system.

Install the 165 mm diameter semispherical head form on the actuator and align the head form such that the path of travel of the head form is horizontal ($0^\circ \pm 2^\circ$) and parallel to the vehicle longitudinal centerline.

Measure the distance between the head form and the impact zone. This distance must be greater than 25 mm.

Set the actuator to propel the head form such that an impact velocity of $23.6 \text{ kph} \pm 0.5 \text{ kph}$ is achieved.

Activate the timing device.

Fire the actuator and verify that the specified velocity is achieved by integrating the acceleration.

Process the acceleration versus time data recorded from the head form accelerometer by using a "3 ms clip" computer routine to establish the maximum (3 ms clip) value of head form acceleration data using SAE J211/1 (March 1995) recommended filter class 600 and cut-off frequency of 1000 Hz.

The deceleration of the head form shall not exceed 785 m/s^2 (80 g) continuously for 3 milliseconds.

Information for the algorithms used to calculate the "3 ms clip" and digitally filter the Class 600 data collected from the energy absorption test is available from the NHTSA website. (<http://www-nrd.nhtsa.dot.gov/software/signal-analysis/index.htm>) Any questions pertaining to the algorithms or requests for the algorithms should be directed to the Crashworthiness Research group, NVS-321.

A copy of the acceleration versus time plot shall be included in the final test report.

Each head restraint shall only be tested once to the energy absorption requirements.

Record all data on Data Sheet 6.

HEIGHT RETENTION (adjustable restraints only)

Position the head restraint in the highest position of adjustment for occupant use. The backset is set at any position of adjustment.

With the seat adjusted as required for the height measurement, locate the centerline of the head restraint.

Rigidly fix the seat back.

Rigidly fixing the seat back may involve welding or blocking the hinge between the seat cushion and the seat back. Additionally an external brace may be welded to the seat frame and to the vehicle body. The method of rigidly fixing the seat back is left to the discretion of the COTR, standard engineer and the contracted test laboratory.

Position the loading device with the attached cylindrical test device above the head restraint. This may require the removal of the vehicle roof or other components. The COTR will be consulted prior to removing any portion of the vehicle.

Position the cylindrical test device with the 152 mm length (axis of revolution) horizontal and parallel to the vehicle longitudinal centerline. The midpoint of the bottom surface of the cylinder shall contact the head restraint such that the vertical centerline of the head restraint coincides with a diameter of the cylinder.

The initial position for measuring displacement (“zero” the displacement measurement equipment) for the 50 N initial load application is achieved when the cylinder is touching the head restraint, without significant load,

All loads are applied and released at $250 \text{ N} \pm 50 \text{ N/minute}$.

Apply the initial load of $50 \text{ N} \pm 1 \text{ N}$.

Maintain the load for 5 seconds.

Record the displacement of the cylindrical test device at the 50 N load, D1.

The initial displacement, D1, must be less than or equal to 25 mm.

Apply an additional load of $445 \text{ N} \pm 5 \text{ N}$ for a total load of $495 \text{ N} \pm 5 \text{ N}$.

Maintain the $495 \text{ N} \pm 5 \text{ N}$ load for at least 5 seconds.

Record the displacement of the cylindrical test device at the 495 N load, D2.

Maintain the load for 5 seconds.

Record the displacement of the cylindrical test device at the 50 N load, D3.

Subtract D1 from D3 to determine the total displacement, DT.

The total displacement, DT shall be less than 13 mm.

Recording D2 is for reference only and does not determine the passage or failure of the head restraint.

A copy of the load versus time plot, displacement versus time, and load versus displacement plot shall be included in the final test report.

Record all data on Data Sheet 7.

BACKSET RETENTION, DISPLACEMENT, AND STRENGTH

If the head restraint is adjustable, adjust the front seat head restraint height to the position closest to and not less than 800 mm and the rear seat head restraint height to the position closest to and not less than 750 mm. If the rear seat head restraint is less than 750 mm in height due to roofline or backlight interference, place the restraint at the highest position of adjustment. The backset is set at any position of adjustment. If the head restraint, in the lowest position of adjustment, has a height greater than 800 mm for front seats or 750 mm for rear seats, adjust the head restraint to the lowest position of height adjustment.

Note: Refer to the appropriate “Dimensional Requirements” section for instructions regarding the adjustment and determination of the height of a head restraint for setting the seat for the backset retention, displacement and strength tests.

Place a test device, having the back pan dimensions and torso line of the SAE J826 three-dimensional manikin, at the previously determined H-point. Rotate the test device against the seat back so that the torso angle is the same as the torso angle of the SAE J826 three-dimensional manikin.

Establish the displaced torso reference line by applying, a rearward moment of 373 ± 7.5 Nm about the H-point, to the seat back. Apply the load at a rate that creates the moment rate of 187 ± 37 Nm/minute.

The initial location of the moment generating load on the back pan of the test device is 290 ± 13 mm above the H-point. The force vector is to be applied perpendicular to the torso reference line. Rotate the force vector with the back pan.

Maintain the displaced torso reference line.

Rigidly fix the seat back.

Rigidly fixing the seat back may involve blocking the hinge between the seat cushion and the seat back. Additionally an external brace may be welded to the seat frame and to the vehicle body. The method of rigidly fixing the seat back shall be approved by the

COTR, standard engineer and the contracted test laboratory. In rigidly fixing the seatback for the backset retention test, it is important to use an apparatus or method that permits the seatback to be “unfixed” for the strength test.

Install a linear displacement transducer between the load actuator and head form. Orient the transducer to measure head form displacement in the rearward direction perpendicular to the displaced torso reference line.

Position the 165 mm diameter spherical head form such that the head form is tangent to the surface of the head restraint.

The head form is positioned in the vertical direction such that the point of tangency is on the line established during the head restraint width measurement.

The head form is positioned in the horizontal direction such that the point of tangency is equidistant from the outboard and inboard edges of the head restraint.

The head form shall be rotated such that the applied force vector is perpendicular to the displaced torso reference line.

Apply the initial moment at a rate of 187 ± 37 Nm/minute.

Apply an initial load to create a rearward moment of 37 ± 0.7 Nm about the H-point.

Maintain the load for 5 seconds.

Record the displacement of the head form, D1.

The initial displacement, D1, must be less than or equal to 25 mm.

Apply an additional load to create a total rearward moment of 373 ± 7.5 Nm.

Apply the additional moment at a rate of 187 ± 37 Nm/minute.

Maintain the 373 ± 7.5 Nm moment for at least 5 seconds.

Record the displacement of the head form, D2.

The maximum displacement, D2, shall be less than or equal to 102 mm.

Reduce the moment to 37 ± 0.7 Nm

The moment is reduced at a rate of 187 ± 37 Nm/minute.

Maintain the load for 5 seconds.

Record the displacement of the head form, D3.

Subtract D1 from D3 to determine the total displacement, DT.

The total displacement, DT, shall be less than 13 mm.

Unfix the seat (Remove the apparatus that is rigidly fixing the seatback).

Increase the load applied to the head restraint, through the head form, to 885 N.

Apply the load at the rate of $250 \text{ N} \pm 50 \text{ N/minute}$.

Maintain the $885 \text{ N} \pm 5 \text{ N}$ load for at least 5 seconds.

Record the maximum load attained by the head restraint. If the maximum load is less than 885 N, the head restraint fails. Record on Data Sheet 8.

Remove the load and take posttest photographs.

A copy of the load versus time plot, displacement versus time, and load versus displacement plot shall be included in the final test report.

Record all data on Data Sheet 8.

PHOTOGRAPHIC DOCUMENTATION

Photographs shall be color, 8" x 10" or 8.5" x 11" and legible. A tag, label, or placard identifying the test vehicle model and NHTSA number shall appear in each photograph and be legible. Each photograph shall be labeled as to the subject matter. The test setup and equipment used in all tests shall be photographed for the record before and at prescribed time periods during testing. Any failure must be photographed at various angles to assure complete coverage. As a minimum the following photographs shall be included:

- A. Left side view of vehicle
- B. Right side view of vehicle
- C. 3/4 frontal view from left side of vehicle
- D. 3/4 rear view from right side of vehicle
- E. Vehicle's certification label
- F. Vehicle's tire information label
- G. 3/4 frontal view of each head restraint system
- E. J826 manikin positioned, as required by the standard, in each DSP
- F. Measurement of head restraint height (highest and lowest position of adjustment)

- G. Measurement of head restraint width
- H. HRMD positioned, as required by the standard
- I. Measurement of backset
- J. Measurement of gaps
- K. Action necessary for head restraint adjustment (if applicable)
- L. Action necessary for head restraint removal (if applicable)
- M. Reinstallation of the rear head restraint (if applicable)
- N. For head restraints with a manual non-use position: (if applicable)
 - a. Side view of head restraint in a position of occupant use showing the reference line and the initial inclination of the line
 - b. Side view of head restraint in a non-use position showing the reference line and the inclination of the line
- O. For head restraints with an automatic non-use position: (if applicable)
 - a. Side view of head restraint in a non-use position
 - b. Side view of head restraint in a position of occupant use with the 5th percentile female Hybrid III Subpart O dummy positioned in the seat
- P. Pretest setup for the energy absorption test
- Q. Impact zone for energy absorption test
- R. Overall seat back and head restraint post-energy absorption test
- S. Pretest setup for height retention test
- T. Head restraint with initial 50 N load applied during the height retention test
- U. Head restraint with maximum applied load during the height retention test
- V. Head restraint after load reduction to 50 N during the height retention test
- W. Head restraint after all load is removed following the height retention test
- X. Pretest setup for the backset retention, displacement, and strength test
- Y. Test device with back pan dimensions of the SAE J826 manikin under load to

show displaced torso reference line

Z. Head restraint with initial 37 Nm moment applied

AA. Head restraint with 373 Nm moment applied

BB. Head restraint with 37 Nm moment after the 373 Nm moment is applied

CC. Head restraint with 895 N load applied

DD. Head restraint after the 895 N load is removed

POST TEST REQUIREMENTS

The contractor shall re-verify all instrumentation and check data sheets and photographs. Make sure data is recorded in all data blocks on every compliance test data sheet.

Consult the contract for all required deliverables and timelines.

DATA SHEET 1**SUMMARY OF RESULTS**

VEH. MOD YR/MAKE/MODEL/BODY STYLE: _____

VEH. NHTSA NO.: _____ ; VIN: _____

VEH. BUILD DATE: _____ ; TEST DATE: _____

TEST LABORATORY: _____

OBSERVERS: _____

A. VISUAL INSPECTION OF TEST VEHICLE

Upon receipt for completeness, function, and discrepancies or damage which might influence the testing.

RESULTS:

B. DIMENSIONAL REQUIREMENTS	PASS	FAIL	
Driver's Side	_____	_____	
Passenger's Side	_____	_____	
Rear Designated Seating Positions	_____	_____	
C. OWNER'S MANUAL	PASS	FAIL	
D. REMOVABILITY	PASS	FAIL	N/A
Driver's Side	_____	_____	
Passenger's Side	_____	_____	
Rear Designated Seating Positions	_____	_____	
E. NON-USE POSITION	PASS	FAIL	N/A
Rear Designated Seating Positions	_____	_____	
F. ENERGY ABSORPTION TEST	PASS	FAIL	
Driver's Side	_____	_____	
Passenger's Side	_____	_____	

Rear Designated Seating Positions	_____	_____
-----------------------------------	-------	-------

G. HEIGHT RETENTION TEST	PASS	FAIL
---------------------------------	-------------	-------------

Driver's Side	_____	_____
---------------	-------	-------

Passenger's Side	_____	_____
------------------	-------	-------

Rear Designated Seating Positions	_____	_____
-----------------------------------	-------	-------

H. BACKSET RETENTION TEST	PASS	FAIL
----------------------------------	-------------	-------------

Driver's Side	_____	_____
---------------	-------	-------

Passenger's Side	_____	_____
------------------	-------	-------

Rear Designated Seating Positions	_____	_____
-----------------------------------	-------	-------

RECORDED BY: _____	DATE: _____
--------------------	-------------

APPROVED BY: _____

DATA SHEET 2

DIMENSIONAL REQUIREMENTS FOR FIXED HEAD RESTRAINTS

VEH. NHTSA NO.:

TEST DATE:

Seat Location:

Height Measurement

SAE J826 three-dimensional manikin torso angle:

Striker to H-Point (mm):

Striker to H-Point angle:

Height, H (mm):

PASS

FAIL

H > or = 800 mm for front seats.

H > or = 750 mm for rear seats with head restraints.

If the head restraint is less than the required height, check for passage of the 25 mm diameter sphere.

Width Measurement

If the manikin is moved between the Height measurement and the Width measurement, re-record the torso angle, striker to H-Point distance and angle.

Width is measured 65 mm below the measured Height, H.

Height, H_w (= H – 65):

Width, W (mm):

PASS

FAIL

Width must be greater than or equal to 170 mm. If a vehicle has a front center designated seating position the front outboard head restraints must be greater than or equal to 254 mm.

Backset Measurement (Front Head Restraints Only)

Position the HRMD and record the following measurements.

HRMD torso angle:

Striker to H-Point (mm):

Striker to H-Point angle:

Backset, B (mm):

PASS

FAIL

Backset must be less than or equal to 55 mm.

Gap Measurement

Number of gaps within the gap measurement zone:

Least dimension of each gap (measured with a steel tape):

Size of each gap (measured with the spherical head form):

Gap Size**PASS****FAIL**

Gaps must be less than or equal to 60 mm.

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

DATA SHEET 2a

DIMENSIONAL REQUIREMENTS FOR ADJUSTABLE HEAD RESTRAINTS

VEH. NHTSA NO.:

TEST DATE:

Seat Location:

Height Measurement

SAE J826 three-dimensional manikin torso angle:

Striker to H-Point (mm):

Striker to H-Point angle:

Position the head restraint in the highest position of vertical adjustment.

Height, Hh (mm):

PASS

FAIL

Hh > or = 800 mm for front seats.

If the head restraint is less than the required height, check for passage of the 25 mm diameter sphere.

Position the head restraint in the lowest position of vertical adjustment.

Height, Hl (mm):

PASS

FAIL

Hl > or = 750 mm for front seats and rear seats with head restraints.

If the head restraint is less than the required height, check for passage of the 25 mm diameter sphere.

Width Measurement

If the manikin is moved between the Height measurement and the Width measurement, re-record the torso angle, striker to H-Point distance and angle.

Position the head restraint in the highest position of vertical adjustment.

Width is measured 65 mm below the measured Height, Hh.

Height, Hw (= Hh – 65):

Width, W (mm):

PASS

FAIL

Width must be greater than or equal to 170 mm. If a vehicle has a front center designated seating position the front outboard head restraints must be greater than or equal to 254 mm.

Backset Measurement (Front Head Restraints Only)

Position the HRMD and record the following measurements.

HRMD torso angle:

Striker to H-Point (mm):

Striker to H-Point angle:

Position the head restraint at a height greater than or equal to 750 mm and less than or equal to 800 mm for front head restraints. Exception: head restraint with lowest position higher than 800 mm, adjust to lowest position.

Backset, B (mm):

PASS

FAIL

Backset must be less than or equal to 55 mm.

Gap Measurement

Position the head restraint in the lowest position of vertical adjustment.

Number of gaps within the gap measurement zone:

Least dimension of each gap (measured with a steel tape):

Size of each gap (as measured with the spherical head form):

Gap Size

PASS

FAIL

Gaps must be less than or equal to 60 mm.

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

DATA SHEET 3**OWNER'S MANUAL**

VEH. NHTSA NO.:

TEST DATE:

Emphasize that all occupants should place their head restraint in a proper position prior to operating the vehicle in order to prevent the risk of serious injury.

PASS**FAIL**

Description of the head restraint system and identification of which seats are equipped.

PASS**FAIL**

If the head restraint is removable, instructions on how to properly remove and reinstall using a deliberate action distinct from any act necessary for adjustment.

PASS**FAIL****N/A**

Warning that all head restraints must be reinstalled properly to protect occupants.

PASS**FAIL**

Describe the adjustment of the head restraints and/or seat back to achieve proper head restraint position relative the head. The description must include the following:

- 1) a presentation and explanation of the main components of the vehicle's head restraints
- 2) the basic requirements for proper head restraint operation, including an explanation of the actions that may affect the proper functioning of the head restraints.
- 3) the basic requirements for proper positioning of a head restraint in relation to an occupant's head position, including information regarding the proper positioning of the center of gravity of an occupant's head in relation to the head restraint.

PASS**FAIL**

Include copies of relevant pages from the owner's manual in the final report.

REMARKS:

RECORDED BY: _____ DATE: _____

APPROVED BY: _____

DATA SHEET 4**REMOVABILITY**

VEH. NHTSA NO.:

TEST DATE:

Are the head restraints removable?

YES**NO**

If removable, does removal REQUIRE an action distinct from actions to adjust the head restraint?

YES (PASS)**NO (FAIL)**

Description of action(s) for head restraint adjustment:

Description of distinct action for removal:

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

DATA SHEET 5

**NON-USE POSITION
(REAR SEAT ONLY, IF APPLICABLE)**

VEH. NHTSA NO.:

TEST DATE:

Is the head restraint designed to **manually** or **automatically** return to an in-use position?

MANUAL**AUTOMATIC**Manual return

With the head restraint in a non-use position draw a straight line on the side of the restraint.

Measure the angle between the line and the horizontal. Initial angle ____ degrees

Position the head restraint in an in-use position.

Measure the angle between the line and horizontal. Final angle ____ degrees

Change in angle = ____ degrees. The change in angle must be > or equal to 60 degrees.

PASS**FAIL**Automatic return

Place the head restraint in a non-use position. Consult the owner's manual for instructions.

Position a 5th percentile female Hybrid III, Subpart O, test dummy in the seat.

Turn the ignition key to the "run" position. Wait 1 minute.

Record the location of the head restraint. Turn the key to the "off" position.

Remove the dummy.

Position the J826 manikin to determine that the height of the head restraint is within the minimum requirements.

Height = ____ mm

PASS**FAIL**

REMARKS:

RECORDED BY: _____ DATE: _____

APPROVED BY: _____

DATA SHEET 6**ENERGY ABSORPTION TEST**

VEH. NHTSA NO.:

TEST DATE:

Seat Location:

Type of head restraint:

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle:

Striker to H-Point (mm):

Striker to H-Point angle:

Description of equipment or method used to rigidly fix the seat back:

Accelerometer identification:

Accelerometer type/brand:

Last calibration date:

Head form vertical angle (-2° - $+2^{\circ}$):Distance between head form and target location ($>$ or $=$ 25 mm):Impact velocity (23.6 kph \pm 0.5 kph):

Impact location:

Maximum deceleration ($<$ or $=$ 785 m/s² (80 g)):**PASS****FAIL**

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

DATA SHEET 7

HEIGHT RETENTION TEST
(ADJUSTABLE HEAD RESTRAINTS ONLY)

VEH. NHTSA NO.:

TEST DATE:

Seat Location:

Pre-test measurements

SAE J826 Manikin torso angle:

Top of Head Restraint Height (mm):

Striker to H-Point (mm):

Striker to H-Point angle:

Description of height retention lock:

Test measurementsInitial load (50 N \pm 1 N):

Initial Displacement, D1 (mm):

Initial Displacement (D1) < 25 mm

PASS FAILMaximum load (495 N \pm 5 N):

Maximum Displacement, D2 (mm):

Return load (50 N \pm 1 N):

Return Displacement, D3 (mm):

Total displacement (D3-D1) < 13 mm:

PASS FAIL

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

DATA SHEET 8

BACKSET RETENTION TEST

VEH. NHTSA NO.:

TEST DATE:

Seat Location:

Type of head restraint:

Pre-test measurements

SAE J826 Manikin torso angle:

Top of Head Restraint Height (mm):

Striker to H-Point (mm):

Striker to H-Point angle:

Displacement torso reference line

Test device back pan angle:

Distance from the H-point to the initial location of the load (0.290 ± 0.013 m):

Initial load (N):

Initial moment (373 ± 7.5 Nm):

Backset retention and strength

Distance from the H-point to the head form tangency point (m):

Initial load (N):

Initial moment (37 ± 0.7 Nm):Initial head form displacement, D1 (≤ 25 mm):**PASS****FAIL**Load range to generate a 373 ± 7.5 Nm rearward moment (N):

Actual load applied (N):

Resultant moment (Nm):

Maximum Head form displacement, D2 (≤ 102 mm):**PASS****FAIL**Final head form displacement, D3 (mm):
measured at (37 ± 0.7 Nm)Total displacement (D3-D1) < 13 mm :**PASS****FAIL**Maximum applied load (≥ 885 N):**PASS****FAIL**

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

FORM 1
TEST EQUIPMENT LIST

VEH. NHTSA NO.:

TEST DATE:

SAMPLE TABLE

ITEM	MFR	MODEL	S/N	CALIBR. PERIOD	DATE OF LAST CALIBRATION	ACCURACY	REMARKS

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

APPENDIX A – VEHICLE SECUREMENT

PURPOSE AND APPLICATION

The Office of Vehicle Safety Compliance (OVSC) provides contracted laboratories with Laboratory Procedures (LPs) which serve as guidelines for common requirements among various standards. The requirements are incorporated into Laboratory Test Procedures (TPs) by reference and are used to determine if a specific vehicle or item of motor vehicle equipment meets the minimum performance requirements of the subject Federal Motor Vehicle Safety Standard (FMVSS). The purpose of the OVSC Laboratory Procedures is to present a uniform testing and data recording format, and provide suggestions for the use of specific equipment and procedures. Any contractor interpreting any part of an OVSC Laboratory Procedure to be in conflict with a Federal Motor Vehicle Safety Standard or observing any deficiencies in a Laboratory Procedure is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing.

The OVSC Laboratory Procedures are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment, which will assist in procuring the required compliance test data.

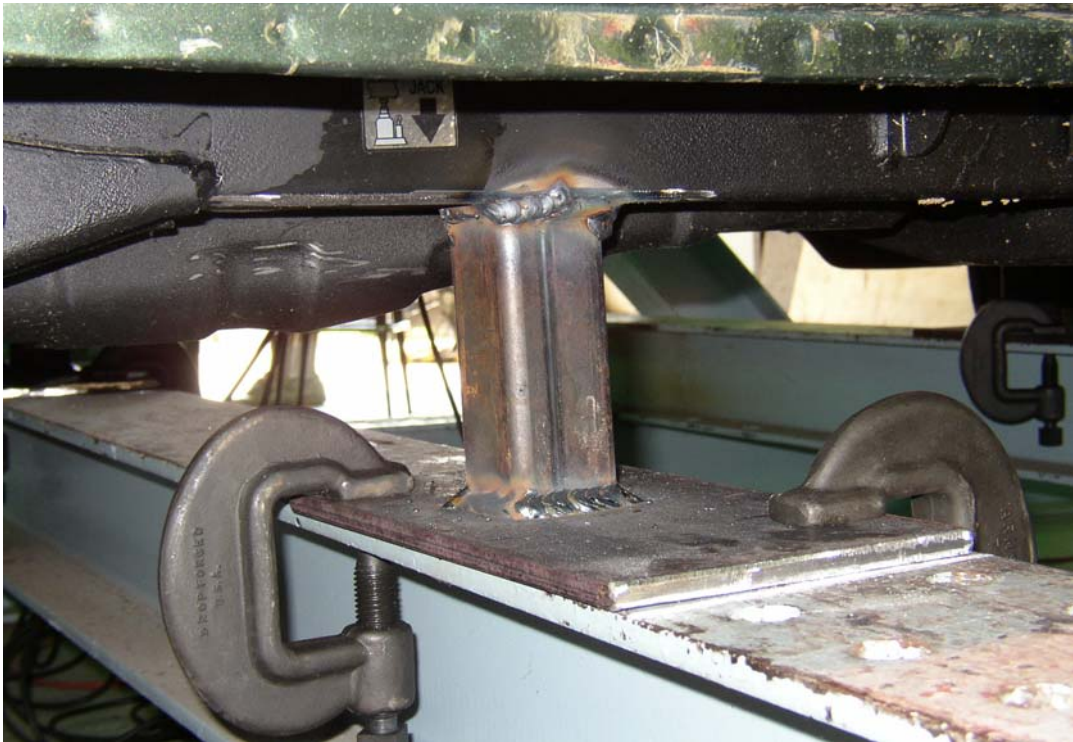
NOTE:

The OVSC Laboratory Procedures, prepared for use by independent laboratories under contract to conduct compliance tests for the OVSC, are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC Laboratory Procedures do not include all of the various FMVSS minimum performance requirements. Sometimes, recognizing applicable test tolerances, the Procedures specify test conditions, which are less severe than the minimum requirements of the standards themselves. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits certification tests to those described in the OVSC Laboratory Test Procedures.

GENERAL REQUIREMENTS

FMVSS 202, 216, and 225 all require a vehicle to be secured off its suspension for testing. This procedure specifies a uniform method for securing vehicles for testing to FMVSS 202, 216, and 225. The vehicle shall be supported by four vertical stands that are welded to the jacking points of the vehicle. The stands shall be attached to a flat, level surface using C-clamps or other method deemed sufficient by the Contracting Officer's Technical Representative (COTR).

PROCEDURE



Photograph of a single vertical support in the “as tested” condition

Record the vehicle attitude with the vehicle resting on its suspension in the “as delivered” condition. The “as delivered” condition is the vehicle as received at the test site, with 100 percent of all fluid capacities, as listed in vehicle owner’s manual, and all tires inflated to the manufacturer’s specifications as listed on the vehicle’s tire placard.

Measure the longitudinal vehicle attitude along both the driver and passenger sill.

Measure the lateral vehicle attitude along the front and rear bumpers at the vehicle centerline.

Locate the vehicle jack points. Refer to the vehicle owner’s manual for identifying the jack points.

If the jack points are not defined or are generally defined, engineering judgment will be used to locate the vertical supports such that the distance between the fore and aft locations are maximized but lie in the region between the front and rear axles.

If the jack points are not located on the vehicle body or the vehicle frame, such as axles or suspension members, the vertical stands will be located in the same manner as vehicles with generally defined jack points.

Make all necessary measurements for fabricating the vertical support stands. A stand is typically comprised of a 3-4" piece of steel tubing that has 6" x 3", 1/4" thick plate welded on end being attached to the bedplate. One piece of 3" x 3", 1/4" thick plate is welded to the jack point.

NOTE: The dimensions provided are simply a guide; depending on vehicle specific parameters the size of the tubing and plates may vary. Variation in stand design may be required based on vehicle geometry or attachment location.

When making measurements, account for the current vehicle attitude and required vehicle attitude when tested. The "as tested" attitude shall be $0^\circ \pm 0.5^\circ$ for both lateral and longitudinal attitude.

Weld a plate to the jack point. Repeat for the three other jack points.

Weld the tubing to the other plate to form a T-shaped stand.

Weld the T-shaped stand to the plate at the jack point. Repeat for the three other jack points.

NOTE: If the vehicle jack points are non-metallic a suitable epoxy or adhesive shall be used to attach the stands.

Fix all non-rigid body mounts to prevent motion of the vehicle body relative to the vehicle frame. This may be achieved by welding or blocking compressible body mounts.

Place the vehicle on the test stand and secure the base of the stands with C-clamps or other suitable method that restraints vehicle motion.

Chains and wire rope shall not be used to secure the vehicle.

The vehicle overhangs shall not be supported.

Measure the longitudinal vehicle attitude along both the driver and passenger sill.

Measure the lateral vehicle attitude along the front and rear bumpers at the vehicle centerline.

The lateral and longitudinal attitudes shall be $0^\circ \pm 0.5^\circ$.

PHOTOGRAPHIC DOCUMENTATION

Photographs shall be color, 8" x 10" or 8.5" x 11" and legible. A tag, label, or placard identifying the test vehicle model and NHTSA number shall appear in each photograph and be legible. Each photograph shall be labeled as to the subject matter. The photographs shall be incorporated into the applicable FMVSS test report. As a minimum the following photographs shall be included:

- A. Each stand attached to the vehicle and mounted to the bedplate.
- B. Overall left side view of vehicle mounted for testing
- C. Overall right side view of vehicle mounted for testing

VEHICLE SECUREMENT DATA SHEET

DATE:

STANDARD TEST(S) BEING PERFORMED:

VEHICLE NUMBER:

VIN:

Description of the location of the vehicle jack points:

Are any of the specified vehicle jack points on the axles or suspension members?

If YES, where are the jack points located?

Where are the vehicle stands located?

Are any of the specified vehicle jack points generally defined?

If YES, where are the jack points located?

Where are the vehicle stands located?

Vehicle attitude "as delivered": Lat: Long:

Vehicle attitude "as tested"; Lat: Long:

REMARKS:

RECORDED BY: _____ DATE: _____

APPROVED BY: _____